



**THE ANSWERS MUST BE ATTEMPTED ON THE ANSWER SHEET PROVIDED**

**Q.1. Solve the following: (5x6=30)**

- (i) Differentiate  $y = x \cos y$  w.r.t  $x$  to find  $\frac{dy}{dx}$ .
- (ii) Evaluate the integrals  $\int x \cos^2 x dx$ .
- (iii) Let  $f(x, y) = xy + \sqrt{xy}$ . Find the first order partial derivative  $\frac{\partial f}{\partial x}$  and  $\frac{\partial f}{\partial y}$ .
- (iv) Find the area bounded the curve  $y = 4 - x^2$  and  $x$ -axis.
- (v) Maximize  $f(x, y) = xy$  subject to the constraint  $x + y = 12$ .

**Q.2. Solve the following: (5x6=30)**

- (a) If  $y = \tan(p \tan^{-1} x)$ , then show that  $(1 + x^2)y' - p(1 + y^2) = 0$ .
- (b) If  $x = a \cos \theta$ ,  $y = a \sin \theta$  then find first and second order derivatives  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$ .
- (c) Evaluate the definite integrals  $\int_1^2 \frac{x}{x^2+1} dx$ .
- (d) A random variable  $X$  has probability density function  $f(x) = kx(1 - x)$ , if  $x \in [0, 1]$ ,  $f(x) = 0$  if  $x \notin [0, 1]$ . Find  $k$  and  $P(\frac{1}{3} \leq x \leq \frac{2}{3})$ .
- (e) Estimate the linear regression line  $y = ax + b$  by using the method of least squares for the data given below. Estimate the value of  $y$  when  $x = 30$ .

x	3	5	6	9	10	12	15	20	22	28
y	10	12	15	18	20	22	27	30	32	34